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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/803,801	HADDAD, KHALIL CAMILLE
	Examiner	Art Unit
	Jason M Perilla	2634

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _20 September 2004_.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-8,10-16,18-26 and 28_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-8,10-16,18-26 and 28_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _12 March 2001_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-8, 10-16, 18-26, and 28 are pending in the instant application.

Response to Arguments/Amendments

2. Applicant's arguments filed September 20, 2004 have been fully considered but they are not persuasive.

Regarding the Applicant's argument against the combination of Kapoor (US 6396886) in view of Haddad et al ("Design of digital Linear-Phase FIR Crossover Systems for Loudspeakers by the Method of vector Space Projections") as applied to the newly amended independent claims 1, 11, and 19, the Applicant asserts that there is no motivation to combine the references to arrive at the claimed invention (page 9, lines 22-30). However, it is noted by the Examiner that the Applicant provides no reason why one skilled in the art would not have been motivated to combine Kapoor with Haddad et al and fails to acknowledge the motivation present in the reference Haddad et al. The Applicant points out that Haddad et al is related to linear filters and supposes that because Kapoor is generally related to shortening impulse response filters (SIRF) that one would not be motivated to combine them. In this case, the Applicant has barely responded to the application of the prior art rejections set forth in the first office action. That is, the Applicant has not considered the motivation available in the reference Haddad et al in the combination of Kapoor in view of Haddad et al. Plainly, Haddad et al teaches:

> "The vector space projection method (VSPM) deals with the problem of finding a mathematical object in a vector space that satisfies

multiple constraints. When all the constraint sets are convex and have a nonempty intersection, there exists a powerful theory in finding the object that satisfies all the constraints." (page 3059, lines 10-16)

Haddad et al further teaches that the desired result of the method of using VSPM is the "solution set" or the set that satisfies all the constraints (page 3059, lines 38-42; fig. 2) and that the VSPM method has significant flexibility in that any number of constraints may be incorporated (page 3063, lines 8-11). Therefore, the use of VSPM in the multiple constraint condition (time and frequency) generation of filter coefficients disclosed by Kapoor is advantageous because it is an exemplary method to solve for the "solution set" of coefficients which satisfy both the time and frequency domain conditions and it may be applied with any number of constraints. Thereby, the Examiner has presented the motivation readily available to one of ordinary skill in the art in the reference to Haddad et al.

Regarding the Applicant's argument against the rejection of claims 3, 13, and 21 under 35 USC § 103(a) as being unpatentable over Kapoor in view of Goldberg et al ("Design of Finite Impulse Response Digital Filters with Nonlinear Phase Response"), the rejections are withdrawn because, as noted by the Applicant, Haddad et al is limited to convex sets or linear filters. Therefore, the application of Kapoor in view of Haddad meeting the limitations of claim 1 does not lend to the additional teachings of Goldberg et al because one skilled in the art would not be able to combine the teachings of Goldberg et al with those of Haddad et al since Haddad et al is related to VSPM methods for linear filters and not non-linear filters.

The rejections of claims 7 and 8 are presented in the first office action are withdrawn because they failed to disclose all the limitations of the claim as defined in the newly amended version of the claims.

New art rejections are presented herein based upon the newly cited reference Haddad, Khalil C. ("Constrained FIR Filter Design by the Method of Vector Space Projections", Haddad, Khalil C. et al).

Claim Objections

3. Claims 1-8, 10-16, 18-26, and 28 are objected to because of the following informalities:

Regarding claim 1, in line 4, "set defining" should be replaced by –set of defining--, and, in line 6, "set defining" should be replaced by –set of defining—to clarify the claim language. Further, in lines 8-9, "said at least one set defining said time domain constraints" should be replaced by –said at least one set of defining constraints that said SIRF filter must satisfy in the time domain-- and "said at least one set defining said frequency domain constraints" should be replaced by -- said at least one set of defining constraints that said SIRF filter must satisfy in the frequency domain— for proper antecedent basis of the limitations.

Regarding claim 2, in line 2, "one set defining" should be replaced by –one set of defining--, "in a frequency" should be replaced by –in the frequency--, and, in line 3, "a linear phase" should be replaced by –a linear phase response--.

Regarding claim 3, in line 2, "one set defining" should be replaced by –one set of defining--, "in a frequency" should be replaced by –in the frequency--, and, in line 3, "a non-linear phase" should be replaced by –a non-linear phase response--.

Regarding claim 4, in lines 1-2, "said time domain constraints" is lacking antecedent basis. It is suggested by the Examiner that "said time domain constraints" is replaced by "the time domain constraints".

Regarding claim 5, in lines 1-2, "said frequency domain constraints" is lacking antecedent basis. It is suggested by the Examiner that "said frequency domain constraints" is replaced by "the frequency domain constraints".

Regarding claim 6, in lines 1-2, "said frequency domain constraints" is lacking antecedent basis. It is suggested by the Examiner that "said frequency domain constraints" is replaced by "the frequency domain constraints".

Regarding claim 7, in line 2, "said at least one set defining said frequency domain constraints" should be replaced by –said at least one set of defining constraints that the SIRF filter must satisfy in the frequency domain--.

Regarding claim 8, in line 2, "said at least one set defining said frequency domain constraints" should be replaced by –said at least one set of defining constraints that the SIRF filter must satisfy in the frequency domain--.

Regarding claim 10, the claim may no longer depend upon claim 9. In lines 2-3, "said at least one set defining said time domain constraints" is lacking antecedent basis, in lines 3-4, "said at least one set defining said frequency domain constraints" is lacking antecedent basis, and, in line 4, "said sets converge" should be replaced by –the sets

converge--. Further, the claim is objected to because the time domain constraints and the frequency domain constraints would not converge to a set of coefficients because they are exclusive of each other. The claim must be amended to link the coefficients of the filter with the time and frequency domain constraints in such a manner that the coefficients are related to the constraints. Otherwise, it is could not be held that the time and frequency domain constraints would converge to a set of coefficients simply by an iterative application of vector space projection methods between them.

Regarding claim 11, in lines 8-9, “said at least one set defining said time domain constraints and said at least one set defining said frequency domain constraints” should be replaced by – said at least one first set defining said time domain constraints and said at least one second set defining said frequency domain constraints--.

Regarding claim 12, in lines 1-2, “said at least one set” should be replaced by – said at least one second set”, and, in line 3, “a linear phase” should be replaced by –a linear phase response--.

Regarding claim 13, in lines 1-2, “said at least one set” should be replaced by – said at least one second set”, and, in line 3, “a non-linear phase” should be replaced by –a non-linear phase response--.

Regarding claim 14, in line 1, “said” should be replaced by –the--.

Regarding claim 15, in line 1, “said” should be replaced by –the--.

Regarding claim 16, in line 1, “said” should be replaced by –the--.

Regarding claim 18, the claim may no longer depend upon claim 17 In line 2, “said at least one set defining” should be replaced by –said at least one first set

defining--, in line 3, “said at least one set defining” should be replaced by –said at least one second set defining--, and, in line 4, “said sets converge” should be replaced by –the sets converge--. Further, the claim is objected to because the time domain constraints and the frequency domain constraints would not converge to a set of coefficients because they are exclusive of each other. The claim must be amended to link the coefficients of the filter with the time and frequency domain constraints in such a manner that the coefficients are related to the constraints. Otherwise, it is could not be held that the time and frequency domain constraints would converge to a set of coefficients simply by an iterative application of vector space projection methods between them.

Regarding claims 19-26, and 28, the claims are objected to for the same reasons as applied to claims 1-8 and 10 above.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 1-8, 10, 19-26 and 28 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 1, the determination of an intersecting set in line 8 is not definite because one skilled in the art is not able to determine what the intersecting set is comprised of. The claim language is unclear because it is not possible, as understood

by one having skill in the art, to have overlapping time and frequency constraints because the time domain constraints and the frequency domain constraints are mutually exclusive by definition. Therefore, with this possible interpretation of the intersecting set removed, one skilled in the art is unable to determine what an intersecting set would be comprised of. The claim must be amended so that one having ordinary skill in the art is able to clearly and definitely determine the meaning of an intersecting set.

Regarding claims 2-8, and 10, the claims are rejected as being based upon a rejected parent claim.

Regarding claim 19, the claim is rejected for the same reasons as applied to claim 1 above.

Regarding claims 20-16, and 28, the claims are rejected as being based upon a rejected parent claim.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 1, 4-6, 10, 11, 14-6, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kapoor (US 6396886 – previously cited) in view of Haddad et al ("Design of Digital Linear-Phase FIR Crossover Systems of Loudspeakers by the Method of Vector Space Projections", Haddad, Khalil C. et al; hereafter "Haddad" – previously cited).

Regarding claim 1, Kapoor discloses a method for determining coefficient values for a shortening impulse response filter (SIRF) (fig. 1; col. 4, lines 18-30), said method comprising the steps of: establishing at least one set defining constraints that said SIRF filter must satisfy in a time domain (col. 4, lines 4-10; col. 6, lines 50-57); establishing at least one set defining constraints that said SIRF filter must satisfy in a frequency domain (col. 4, lines 10-13; col. 6, lines 58-63); and determining an intersecting set of said at least one set defining said time domain constraints and said at least one set defining said frequency domain constraints. It is inherent that an intersecting set of the time domain constraints and the frequency domain constraints is determined because the method for determining coefficient values of Kapoor accounts for both the time domain constraints as well as the frequency domain constraints. Kapoor does not disclose the use of a vector space projection method to determine the intersecting set. However, the method of vector space projection is already well known as published and taught by Haddad (pg. 3059, col. 2). Haddad teaches a method to solve a mathematical problem encompassing multiple constraints by vector space projection (page 3059, lines 10-16). Haddad et al further teaches that the desired result of the method of using VSPM is the "solution set" or the set that satisfies all the constraints (page 3059, lines 38-42; fig. 2) and that the VSPM method has significant flexibility in that any number of constraints may be incorporated (page 3063, lines 8-11). Therefore, the use of VSPM in the multiple constraint condition (time and frequency) generation of filter coefficients disclosed by Kapoor is advantageous because it is an exemplary method to solve for the "solution set" of coefficients which satisfy both the time and

frequency domain conditions and it may be applied with any number of constraints. Therefore, it would have been obvious to one having ordinary skill in the art to utilize vector space projection as taught by Haddad in the method of Kapoor because it allows constraint flexibility and can be advantageously used to solve the mathematical problem of multiple constraints.

Regarding claim 4, Kapoor in view of Haddad disclose the limitations of claim 1 as applied above. Further, Kapoor discloses that the time domain constraints specify a shortening of a channel impulse response (col. 2, lines 31-40; col. 4, lines 4-9).

Regarding claim 5, Kapoor in view of Haddad disclose the limitations of claim 1 as applied above. Further, Haddad discloses that the frequency domain constraints include a frequency response for the SIRF filter that does not attenuate a received signal (fig. 3). Figure 3 of Haddad illustrates frequency domain attenuation regions for various filters which do not attenuate a received signal because they have a flat magnitude response.

Regarding claim 6, Kapoor in view of Haddad disclose the limitations of claim 1 as applied above. Further, Haddad discloses that the frequency domain constraints include a pass-band for said SIRF filter (fig. 3.). Figure 3 of Haddad illustrates frequency domain attenuation regions for various filters which include pass-band regions because they have a flat magnitude response or pass-band over a range of frequencies.

Regarding claim 10, Kapoor in view of Haddad disclose the limitations of claim 1 as applied above. Further, Haddad discloses that the VSPM method is iteratively

applied between the time and frequency domain constraints until the sets converge (fig. 2).

Regarding claim 11, Kapoor discloses a shortening impulse response filter (SIRF), comprising: a set of finite impulse response (FIR) coefficients (col. 4, lines 17-19) satisfying at least one constraint in a time domain (col. 4, lines 4-10; col. 6, lines 50-57) and at least one constraint in a frequency domain (col. 4, lines 10-13; col. 6, lines 58-63), wherein said at least one time domain constraint is represented as at least one first set and wherein said at least one frequency domain constraint is represented as at least one second set (col. 4, lines 4-13), wherein said finite impulse response (FIR) coefficients are determined by an intersecting set of said at least one set defining said time domain constraints and said at least one set defining said frequency domain constraints. It is inherent that the constraints are represented by a "set" and that an intersecting set of the time domain constraints and the frequency domain constraints is determined because the method for determining coefficient values of Kapoor accounts for both the time domain constraints as well as the frequency domain constraints. Kapoor does not disclose the use of a vector space projection method to determine the intersecting set. However, the method of vector space projection is already well known as published and taught by Haddad (pg. 3059, col. 2). Haddad teaches a method to solve a mathematical problem encompassing multiple constraints by vector space projection (page 3059, lines 10-16). Haddad et al further teaches that the desired result of the method of using VSPM is the "solution set" or the set that satisfies all the constraints (page 3059, lines 38-42; fig. 2) and that the VSPM method has significant

flexibility in that any number of constraints may be incorporated (page 3063, lines 8-11). Therefore, the use of VSPM in the multiple constraint condition (time and frequency) generation of filter coefficients disclosed by Kapoor is advantageous because it is an exemplary method to solve for the "solution set" of coefficients which satisfy both the time and frequency domain conditions and it may be applied with any number of constraints. Therefore, it would have been obvious to one having ordinary skill in the art to utilize vector space projection as taught by Haddad in the method of Kapoor because it allows constraint flexibility and can be advantageously used to solve the mathematical problem of multiple constraints.

Regarding claim 14, Kapoor in view of Haddad discloses the limitations of claim 1 as applied above. Further, Kapoor discloses that the time domain constraints specify a shortening of a channel impulse response (col. 2, lines 31-40; col. 4, lines 4-9).

Regarding claim 15, Kapoor in view of Haddad disclose the limitations of claim 11 as applied above. Further, Haddad discloses that the frequency domain constraints include a frequency response for the SIRF filter that does not attenuate a received signal (fig. 3). Figure 3 of Haddad illustrates frequency domain attenuation regions for various filters which do not attenuate a received signal because they have a flat magnitude response.

Regarding claim 16, Kapoor in view of Haddad disclose the limitations of claim 11 as applied above. Further, Haddad discloses that the frequency domain constraints include a pass-band for said SIRF filter (fig. 3.). Figure 3 of Haddad illustrates frequency domain attenuation regions for various filters which include pass-band

regions because they have a flat magnitude response or pass-band over a range of frequencies.

Regarding claim 18, Kapoor in view of Haddad disclose the limitations of claim 11 as applied above. Further, Haddad discloses that the VSPM method is iteratively applied between the time and frequency domain constraints until the sets converge (fig. 2).

8. Claims 2 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kapoor in view of Haddad, and in further view of Shinde (US 6192386).

Regarding claim 2, Kapoor in view of Haddad disclose the limitations of claim 1 as applied above. Kapoor in view of Haddad does not disclose that the at least one set defining constraints that said SIRF filter must satisfy in a frequency domain define a filter having a linear phase. However, Shinde teaches an analogous digital finite impulse response (FIR) filter (abstract). Shinde also teaches that an advantage of a linear filter is that it does not produce any phase distortion with respect to the input frequency (col. 7, line 64-col. 8, line 8). One skilled in the art is familiar with the design of digital filters and how to design both linear and non-linear phase filters with respect to any chosen design constraint. It is common that the design constraints alone may define the filter to have a linear or non-linear phase output with respect to the input. Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to set defining constraints that the SIRF filter must satisfy to define a filter having a linear phase as taught by Shinde in the method of Kapoor in view of Haddad because such methods are commonly known in the art, and the linear

phase characteristic of the filter would not produce distortion in phase across various frequencies.

Regarding claim 12, Kapoor in view of Haddad disclose the limitations of claim 11 as applied above. Kapoor in view of Haddad does not disclose that the at least one set defining constraints that said SIRF filter must satisfy in a frequency domain define a filter having a linear phase. However, Shinde teaches an analogous digital finite impulse response (FIR) filter (abstract). Shinde also teaches that an advantage of a linear filter is that it does not produce any phase distortion with respect to the input frequency (col. 7, line 64-col. 8, line 8). One skilled in the art is familiar with the design of digital filters and how to design both linear and non-linear phase filters with respect to any chosen design constraint. It is common that the design constraints alone may define the filter to have a linear or non-linear phase output with respect to the input. Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to set defining constraints that the SIRF filter must satisfy to define a filter having a linear phase as taught by Shinde in the method of Kapoor in view of Haddad because such methods are commonly known in the art, and the linear phase characteristic of the filter would not produce distortion in phase across various frequencies.

9. Claims 19, 22-24 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kapoor in view of Haddad, and in further view of Gandhi et al (US 6112218; hereafter "Ghandi" – previously cited).

Regarding claim 19, Kapoor in view of Haddad discloses a method for determining coefficient values for a shortening impulse response filter (SIRF) as applied to claim 1 above. Although digital signal processors (DSP) executing instructions stored on memory communicatively coupled to them are notoriously known for implementing inventions which process digital information, Kapoor in view of Haddad does not disclose the use of one. However, Ghandi does teach the use of a DSP and a memory for implementing a filter (abstract; col. 18, lines 28-35). Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to utilize a memory and a DSP as taught by Ghandi in the method of Kapoor in view of Haddad because it provides an exceptionally flexible means to implement the filter.

Regarding claim 22, Kapoor in view of Haddad, and in further view of Gandhi disclose the limitations of claim 19 as applied above. Further, Kapoor discloses that the time domain constraints specify a shortening of a channel impulse response (col. 2, lines 31-40; col. 4, lines 4-9).

Regarding claim 23, Kapoor in view of Haddad, and in further view of Gandhi disclose the limitations of claim 19 as applied above. Further, Haddad discloses that the frequency domain constraints include a frequency response for the SIRF filter that does not attenuate a received signal (fig. 3). Figure 3 of Haddad illustrates frequency domain attenuation regions for various filters which do not attenuate a received signal because they have a flat magnitude response.

Regarding claim 24, Kapoor in view of Haddad, and in further view of Gandhi disclose the limitations of claim 19 as applied above. Further, Haddad discloses that

the frequency domain constraints include a pass-band for said SIRF filter (fig. 3.). Figure 3 of Haddad illustrates frequency domain attenuation regions for various filters which include pass-band regions because they have a flat magnitude response or pass-band over a range of frequencies.

Regarding claim 28, Kapoor in view of Haddad, and in further view of Gandhi disclose the limitations of claim 19 as applied above. Further, Haddad discloses that the VSPM method is iteratively applied between the time and frequency domain constraints until the sets converge (fig. 2).

10. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kapoor in view of Haddad, in further view of Ghandi, and in further view of Shinde.

Regarding claim 20, Kapoor in view of Haddad, and in further view of Ghandi disclose the limitations of claim 19 as applied above. Kapoor in view of Ghandi do not disclose that the at least one set defining constraints that said SIRF filter must satisfy in a frequency domain define a filter having a linear phase. However, Shinde teaches an analogous digital finite impulse response (FIR) filter (abstract). Shinde also teaches that an advantage of a linear filter is that it does not produce any phase distortion with respect to the input frequency (col. 7, line 64-col. 8, line 8). One skilled in the art is familiar with the design of digital filters and how to design both linear and non-linear phase filters with respect to any chosen design constraint. It is common that the design constraints alone may define the filter to have a linear or non-linear phase output with respect to the input. Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to set defining constraints that the

SIRF filter must satisfy to define a filter having a linear phase as taught by Shinde in the method of Kapoor in view of Haddad because such methods are commonly known in the art, and the linear phase characteristic of the filter would not produce distortion in phase across various frequencies.

* * * * *

11. Claims 1-8, 10-16, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kapoor in view of Haddad, Khalil C. ("Constrained FIR Filter Design by the Method of Vector Space Projections", Haddad, Khalil C. et al; hereafter "Khalil" – newly cited).

Regarding claim 1, Kapoor discloses a method for determining coefficient values for a shortening impulse response filter (SIRF) (fig. 1; col. 4, lines 18-30), said method comprising the steps of: establishing at least one set defining constraints that said SIRF filter must satisfy in a time domain (col. 4, lines 4-10; col. 6, lines 50-57); establishing at least one set defining constraints that said SIRF filter must satisfy in a frequency domain (col. 4, lines 10-13; col. 6, lines 58-63); and determining an intersecting set of said at least one set defining said time domain constraints and said at least one set defining said frequency domain constraints. It is inherent that an intersecting set of the time domain constraints and the frequency domain constraints is determined because the method for determining coefficient values of Kapoor accounts for both the time domain constraints as well as the frequency domain constraints while the coefficients are chosen. Kapoor discloses the use of an eigenfilter method to determine an intersecting set of the time domain and frequency domain constraints (fig. 4b; col. 5, line

65 – col. 6, line 3) but does not disclose the use of vector space projection methods (VSPM) to determine the intersecting set of the time domain and frequency domain constraints. However, Khalil teaches an exemplary method of utilizing VSPM methods to determine an intersecting set (fig. 1) of more than one group of constraints (fig. 1, refs. C1 and C2; page 715, col. 2, lines 7-12). Khalil further teaches VSPM methods hold advantages over eigenfilter methods (page 714, col. 2, lines 2-27) such as the possible incorporation of linear and non-linear constraints and more efficient optimization (page 715, col. 2, lines 28-41). Therefore, it would have been obvious to one having ordinary skill in the art to utilize the VSPM method for finding a solution set in view of multiple groups of constraints as taught by Khalil in the method of Kapoor because the VSPM method of Khalil could be used to solve for the solution set of coefficients which satisfy both the time and frequency domain constraint conditions while providing the advantages of more flexible constraints as compared to eigenfilter methods.

Regarding claim 2, Kapoor in view of Khalil disclose the limitations of claim 1 as applied above. Further, Khalil discloses defining constraints that the SIRF filter must satisfy in the frequency domain define a filter having a linear phase (page 716, col. 1).

Regarding claim 3, Kapoor in view of Khalil disclose the limitations of claim 1 as applied above. Further, Khalil discloses defining constraints that the SIRF filter must satisfy in the frequency domain define a filter having a non-linear phase (page 719, col. 1).

Regarding claim 4, Kapoor in view of Khalil disclose the limitations of claim 1 as applied above. Further, Kapoor discloses that the time domain constraints specify a shortening of a channel impulse response (col. 2, lines 31-40; col. 4, lines 4-9).

Regarding claim 5, Kapoor in view of Khalil disclose the limitations of claim 1 as applied above. Further, Khalil discloses that the frequency domain constraints include a frequency response for the SIRF filter that does not attenuate a received signal (page 716, col. 1, lines 20-40).

Regarding claim 6, Kapoor in view of Khalil disclose the limitations of claim 1 as applied above. Further, Khalil discloses that the frequency domain constraints include a pass-band for said SIRF filter (page 716, col. 1, lines 20-40).

Regarding claim 7, Kapoor in view of Khalil disclose the limitations of claim 2 as applied above. Further, Khalil discloses the additional limitations of claim 7 (page 716, col. 1, lines 20-40; col. 2).

Regarding claim 8, Kapoor in view of Khalil disclose the limitations of claim 3 as applied above. Further, Khalil discloses the additional limitations of claim 8 (page 716, col. 1, lines 20-40; col. 2).

Regarding claim 10, Kapoor in view of Khalil disclose the limitations of claim 1 as applied above. Further, Khalil discloses that the VSPM method is iteratively applied to the frequency and time domain constraints until the set converge (fig. 1)

Regarding claims 11-16, and 18, the limitations of the claims are disclosed by Kapoor in view of Khalil as applied respectively to claims 1-6 and 10 above.

12. Claims 19-26, and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kapoor in view of Khalil, and in further view of Gandhi.

Regarding claim 19, Kapoor in view of Khalil discloses a method for determining coefficient values for a shortening impulse response filter (SIRF) as applied to claim 1 above. Although digital signal processors (DSP) executing instructions stored on memory communicatively coupled to them are notoriously known for implementing inventions which process digital information, Kapoor in view of Khalil does not disclose the use of one. However, Ghandi does teach the use of a DSP and a memory for implementing a filter (abstract; col. 18, lines 28-35). Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to utilize a memory and a DSP as taught by Ghandi in the method of Kapoor in view of Khalil because it provides an exceptionally flexible means to implement the filter.

Regarding claims 20-24, and 28, the limitations of claim 19 are disclosed by Kapoor in view of Khalil, and in further view of Ghandi as applied above. Further, the additional limitations of claims 20-24 and 28 are disclosed by Khalil as applied respectively to claims 2-6 and 10 above.

Regarding claims 25 and 26 the limitations of claims 20 and 21 are disclosed by Kapoor in view of Khalil, and in further view of Ghandi as applied above. Further, the additional limitations of claims 25 and 26 are disclosed by Khalil as applied respectively to claims 7 and 8.

Conclusion

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The following prior art of record not relied upon above is cited to further show the state of the art with respect to vector space projection methods.

Wu et al, "FIR Filter Design via Spectral Factorization and Convex Optimization", Ch 1., *Applied Computational Control, Signal and Communications,* 1997, pages 1-33.

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason M Perilla whose telephone number is (571) 272-3055. The examiner can normally be reached on M-F 8-5 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Chin can be reached on (571) 272-3056. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JMP

Jason M. Perilla
January 13, 2005

jmp

Chieh Min Fan

CHIEH M. FAN
PRIMARY EXAMINER